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ABSTRACT

Implementation of the EDUCOM Financial Planning Model (EFPM) at a European university, in order to test the computer system's generality and applicability, is discussed. This recently developed planning and management model for higher education incorporates both the flexibility of a modeling language and the benefit of interactive operation. Specific design concepts of EFPM that have made the system appear promising for a prototype international implementation are: the system contains no substantive content, and, therefore, makes no implicit assumptions about what is to be modeled or the way in which it is to be modeled; all machine messages and permissable user responses are contained in separate files independent of the program logic; EFPM is to be made available through dial-in networks rather than software installation at each user institution. The experimental implementation of EFPM in Europe was carried out at the Catholic University of Louvain in Belgium. Special attributes of the system and the implementation techniques that led to the successful installation and use of EFPM are described. Prospects for future international usage of such systems by means of data line networks are also discussed. (SW)

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AN AMERICAN MODELING SYSTEM IN EUROPE

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ABSTRACT

Previous financial planning and resource allocation models have generally been designed for specific types of institutions in specific countries. Because of their lack of flexibility and complicated structure, they have been almost impossible to apply elsewhere. This paper identifies a set of design characteristics that help make a model internationally applicable, and describes the insights gained when one such American modeling system was implemented at a French-language European university.

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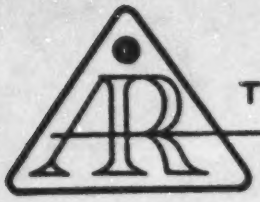

THE ASSOCIATION FOR INSTITUTIONAL RESEARCH

This paper was presented at the Twentieth Annual Forum of the Association for Institutional Research held at the Peachtree Plaza Hotel in Atlanta, Georgia, April 27 - May 1, 1980. This paper was reviewed by the AIR Forum Publications Committee and was judged to be of high quality and of interest to others concerned with the research of higher education. It has therefore been selected to be included in the ERIC Collection of Forum papers.

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AN AMERICAN MODELING SYSTEM IN EUROPE

The development and use of computerized models for planning and management in higher education continues to be a topic of lively interest; see, for example, Mason (1976), Wyatt, Emery, and Landis (1979), and Watkins (1980). Although many institutions at various times have developed specialized models to aid in the analysis of specific management problems, the substantial monetary resources and computer expertise required to construct such models from scratch have generally discouraged all but the most straightforward, narrowly focused development efforts. These circumstances have led to the development of several generalized, comprehensive management models -- intended for application at a wide variety of higher education institutions, and designed to aid in the analysis of institution-wide resource allocation decisions. The well publicized appearance of RRPM, CAMPUS, and SEARCH in North America stimulated the development of less heavily promoted, and somewhat more context-specific, European planning models such as GERN in Belgium, MSAR in Portugal, HIS in Germany, and TUSS in the Netherlands. These models are described and compared in Hussain (1976a, 1976b), Cossu (1978), and Hecquet and Jadot (1978).

Despite their intended wide applicability, however, the structural rigidity characteristic of virtually all such large-scale models for higher education has severely limited their usage both in North America and abroad; see Hopkins (1971) and Plourde (1976, 1978). Their predetermined data requirements and pre-formatted output reports often have hindered adequate representation of an institution's particular organizational structure or instructional programs, and the implicit conceptual model of institutional organization and operation underlying the program logic (Sheehan and Gulko [1976]) frequently has failed

to reflect basic procedural constraints or decision-making criteria -- not to mention effects of managerial style -- in determining resource allocations at the institution. The use of such modeling tools at national levels of planning, moreover, has been subject to even greater criticism; see Dresch (1975) and Lyell (1976).

The need for managerial models that can be more individually tailored to the user institution, while still avoiding costly systems-redesign activities has led to the emergence of modeling systems or modeling languages that, of themselves, contain little or no content, but which provide the user with great flexibility in building and operating models. An early modeling system for higher education incorporating such design features was HELP/PLANTRAN. The acceptance and use of this system would undoubtedly have been more widespread had many of the recent advances in computer technology been available at that time. For example, experience in higher education and in industry now strongly suggests that modeling systems of this type can be most effectively used by decision makers if the systems are interactive -- that is, operated from a personal computer terminal -- rather than being either manually operated or batch processed (as is the case with HELP/PLANTRAN). Also, as will be discussed later, the rapidly improving availability of computer networks and their accompanying benefits of remote access to major computer installations now brings such modeling systems within the reach (both technically and financially) of virtually all institutions of higher education.

A recently developed planning and management system for higher education, incorporating the flexibility of a modeling language together with the benefits of interactive operation and network access, is known as the EDUCOM Financial Planning Model (EFPM). (See Updegrove [1979a, 1979b] for a description of the origins and technical structure of EFPM.) The fundamental design principles of

this system, based upon earlier modeling work at Stanford University and developed under a grant from the Lilly Endowment, appeared to address problems of individualized institutional implementation and effective managerial use in so promising a manner that one of the authors of this paper suggested an implementation of the model at a European university as an extreme test of the system's generality and applicability.

Design Concepts

EFPM is a generalized system for model construction and analysis that allows the decision maker to model any facet of institutional operations that is amenable to mathematical analysis. The system incorporates an easily manipulated matrix of 560 rows (variables) and 12 columns (typically time periods), with user-defined names, values, inter-relationships, and output reports (see Jones, et al [1980]). In addition to the forecasting, "what-if", and sensitivity analysis capabilities typical of such modeling systems, EFPM also includes the unique feasibility search and trade-off analysis features developed at Stanford University by Dickmeyer, Hopkins, and Massy (see Hopkins and Massy [1980]). These features incorporate some of the power of operations research models, but in a format and context comfortable to most non-technical decision makers; see Keen (1977).

The specific design concepts of EFPM that made this system appear so promising for a prototype international implementation can be summarized as follows:

1. The system contains no substantive content whatsoever and, therefore, makes no implicit assumptions about what is to be modeled or the way in which it is to be modeled. That is, the descriptors of the institution, the relation-

ships among institutional variables, and the management goals are defined by the user and maintained independent of the program logic. Thus, the organizational, personnel, and financial structure specific to a European university may be entered into the system in a manner completely analogous to the corresponding descriptors of a North American college or university.

2. Although EFPM communicates interactively with the decision maker through a series of conversational question-and-answer dialogues, all system messages and permissable user responses are contained in separate files independent of the program logic. These files, therefore, may be translated into any dialect.

3. A primary developmental goal for this planning system was to make it available to all potential users via public dial-in networks (TYMNET and Telenet) to a central host computer at Cornell University. The selection of such a delivery system (in contrast to software installation at each of the user institutions) offered a means of avoiding the substantial institutional commitments of time and personnel historically required for such individual software installations, as well as providing for instantaneous and simultaneous updating of EFPM for all users as the system's capabilities evolved. Because the two dial-in data networks have installed communications ports in a variety of major European cities, it appeared likely that EFPM could be implemented at a European university through use of such an international network capability -- thus avoiding the potentially difficult technical problems in adapting American software to a European computer system.

The University of Louvain Experience

The experimental implementation of EFPM in Europe was carried out during a sabbatical leave spent in affiliation with the institutional studies office (Services d'Etudes) of the Catholic University of Louvain (UCL) in Louvain-la-Neuve, Belgium. As a major French-language university, with an administrative and personnel structure radically different from any existing in the United States, UCL provided an ideal site for investigating the true generality of the EFPM system. The project was carried out in collaboration with the University's director of budgets, who has now become UCL's chief officer for financial affairs. The author's other committments left only six weeks available for the experimental EFPM implementation; this time period was sufficient, however, to develop and install a comprehensive financial planning model representing the University's entire operating budget.

Undoubtedly the most notable aspect of this experimental EFPM implementation was that, despite the seemingly exotic context of the project, a description of the system's implementation at UCL is virtually indistinguishable from the many similar projects completed in the United States. The following paragraphs detail several specific aspects of the implementation at UCL; the remainder of the paper will then discuss some broader issues and insights derived from this experiment in international systems sharing.

System delivery. The implementation team at UCL profited from a fortuitous circumstance regarding accessibility of the EFPM system: it was found that the computer at UCL was of the same type, and equipped with the identical operating system, as the computer at Cornell University housing the EFPM programs. In hopes of saving both the expense of international network communication from Belgium to the United States and the lead-time ordinarily required to establish usage of such a network, the author requested the EFPM

staff to send a tape of the system for direct installation on the UCL computer. By an extreme stroke of fortune, these two computers proved so compatible that the EFPM software ran on the UCL computer without need for any changes in program contents nor executive procedures.

French translation. Before the Belgium implementation was to begin, all textual material in the EFPM system -- including all user commands, system prompts, and diagnostic messages -- was translated into French. Upon arrival at UCL, moreover, the text files were again revised to incorporate more of the idioms in current usage in Belgium. Thus from the very start, this interactive conversational planning system could be preset to speak and understand French, indicating the feasibility (and, in fact, ease) with which such a system can function as a multiple language planning tool.

Implementation procedure. Once the tape of EFPM in its French-language version had been received at UCL, the implementation procedure followed a pattern strikingly similar to that observed at colleges and universities in the United States. The University's budget director, one of the highest ranking university executives with on-going responsibilities for financial analysis, was introduced to EFPM through a live demonstration of the system -- in this case a French-language case study of a simplified university. He was sufficiently impressed with the system's capabilities to assign a budget analyst on a full-time basis to aid in the construction of a budget model for the university. To assure that this budget model would not be influenced by preconceptions stemming from EFPM's development and usage in the United States, the author suggested that the analyst create the model's principal data files entirely on his own.

The completion of these comprehensive data files by the budget analyst was a crucial element in the successful system implementation in Belgium.

Firstly, he wrote out all files by hand, on input format sheets designed for this purpose, using existing budget documents as his sole source of institutional data. Other necessary data elements, particularly expected growth rates in monetary flows and physical descriptors of the university, were supplied by the budget director himself, on the basis of his own best estimates. This process served as a clear indication that a sophisticated management information system is not a precondition for the use of a planning system such as EFPM. Secondly, the fact that these data files were prepared entirely by the budget analyst (with input from the budget director) assured that all terminology, all abbreviations, all categorizations of budget items, and the overall budget structure would appear in precisely the form most familiar to the University's executive personnel. EFPM, therefore, not only represented a system that spoke their language, but one which appeared totally designed to reflect the structure of their institution.

Model usage. As has been observed in system implementation in the United States, the perceptions of the decision maker (in this case, the budget director) toward EFPM's potential applications and analytic utility underwent a marked change as the full-scale budget model was developed. In terms of this specific model, it became difficult to restrain the budget director from burdening the model with the full level of detail characteristic of the University's budget itself. After repeated discussions, however, the size of the budget model was substantially reduced to permit strategic analysis of major policy alternatives, while still maintaining sufficient detail to provide realistic budget estimates and reports. After the budget model was fully developed, the budget director began considering the possibility of additional models for analyzing the University's administrative services, its extensive capital construction budget, and other specific institutional services such as the computer center

and the student dining facilities. The budget analyst who had helped construct the budget model was also assigned to prepare a local user's manual for the EFPM system.

In terms of actual managerial usage of this planning system, the budget director's first working session with the newly completed budget model furnished a good example of the typical use of such a tool. A variety of hypotheses concerning possible rates of change in the key financial variables affecting UCL's budget were examined, and several different policies regarding the size of the university's reserve accounts were explored. The financial forecasts automatically produced by the system in response to these varying hypotheses ranged from a calculated budget deficit of 11 million francs in the second year of the planning period, to a calculated surplus of 62 million francs in the same year. The wide range of possible financial outcomes as a function of the different hypotheses being explored served to clearly indicate which of the various factors under consideration were most critical to UCL's financial planning and, therefore, should receive the closest subsequent analysis.

Subsequent System Development

The EFPM software was sent to UCL at a fairly early stage in the system's development. Very substantial modifications have been made to the U.S.-based EFPM programs since that time, many of which directly address various operational complexities or inconveniences encountered in the Belgium implementation. In particular, the major emphasis in recent EFPM system modification has been toward making the system more easily manipulated by the non-technical user. Although this system has been designed since its inception to permit institutional implementation without need for computer programming expertise, the version installed at UCL required the continuous participation of a person familiar

with many basic technical aspects of computer operations. The ongoing modifications to EFPM have largely eliminated the need for such expertise on other than an occasional basis; decision makers themselves are now able to perform a major portion of the model construction and editing activities previously requiring computer knowledge, and can themselves call upon powerful built-in software capabilities to reconfigure the system in a variety of ways. Such a capability would have been of enormous help in the latter stages of the UCL implementation project, allowing the budget director himself to experiment with and manipulate various policy alternatives without the pressure of "performing" in the presence of other participating technical personnel.

Assessment

What can one conclude from this suprisingly uneventful and successful implementation of an American planning and management system in a totally European environment? On one hand, it appears clear that several design characteristics of the EFPM system were highly effective in helping overcome many barriers formerly impeding such technological transfer. On the other hand, the implementation experience served to highlight basic similarities between this project and a broad range of implementation experiences in the United States -- similarities that reinforce the validity of basic procedural strategies that seem widely applicable no matter what the institutional context.

In assessing the feasibility of international managerial technology transfer, one thinks immediately of transferability problems caused by differences in organizational, personnel, or financial structures, compounded by differences in language or in local terminology. The implementation project at UCL has shown clearly that the concept of a context-free modeling system with independent, user-specified data files and easily accessible message and

information files can serve effectively to eliminate such international differences as a barrier to technology transfer. A transfer problem of a different nature arising in the context of computerized systems deals with the computer technology itself, and the delivery systems available to provide such technology. This issue will be discussed shortly.

In addition to these types of differences that are fairly objective in nature and relatively easily specified, the success of international technology transfer is equally dependent upon a system's adaptability to a variety of cultural and attitudinal differences. Thus, a management system not only must adequately reflect differences in organizational structure and in language and terminology but must also, for example, respect the role and importance of tradition in shaping decision-making criteria and processes, and present itself in a fashion designed to minimize challenges stemming from nationalistic sentiments. There is no denying, for instance, that many high ranking executives in professions throughout Europe resent what they perceive to be an American imperialism in management technology. Therefore, the ability to demonstrate EFPM to such executives as a computerized system that speaks their language and that models their institution as they are used to seeing it -- in short, to present the system so as to hide the "made in the U.S.A." label -- can be an extremely effective means of reassuring the potential user as to the system's national neutrality, and of encouraging confidence in its applicability.

The UCL implementation, moreover, demonstrated that a local participant could independently dictate model design through the unconstrained creation of data files, thus assuring that many subtle aspects of institutional organization and management policies well established through tradition (although often neither explicitly stated nor observable) would emerge as an integral

part of the model. It is possible that this particular aspect of model adaptability -- the capability of accurately reflecting, and thus demonstrating respect for, traditional structures and national identities -- may emerge as one of EFPM's most important contributions in promoting international usage of planning and management systems.

In contrast to these important national differences highlighted in the UCL implementation -- differences that were effectively resolved through a combination of systems design features and implementation strategies -- there also emerged several key similarities that may be considered almost universal elements in the successful implementation of planning and management systems. These elements have been observed as commonalities in the implementation of EFPM at over 90 colleges and universities in the United States, comprising both public and private institutions ranging from major research universities to small four-year colleges, community colleges, and seminaries. (see Knodle, et al [1979] and Merrill [1980] for descriptions of actual FFPM applications at a variety of institutions).

One such commonly shared characteristic of successful implementations is that the system becomes individually tailored to the user institution. This is primarily a capability that must be inherent in the system itself, and the ability of a system based upon a modeling language to accommodate such a universal need is a recurring theme of this paper. A second common element of successful implementations, this time on the part of the institution, is the existence of what has been termed an "executive godfather" for the project (Wyatt and Zackhauser [1975]). This refers to the presence and active support of a high-level executive officer who understands the potential utility of the system, is excited by its prospective use at the institution, and will actively oversee (if not personally participate in) all aspects of the system's imple-

mentation and systematic usage at the institution.

Finally, observations indicate that the likelihood of continued use of systems for planning and management is enhanced as one overcomes the need for intervention on the part of technical computer specialists. The ideal of a sophisticated planning and analysis tool that decision makers can utilize without the intermediary of technical personnel is being approached through continued advancement in conversational modes of communication between system and user, and through the development of model construction and modification capabilities at the level of the non-technical user. The ultimate goal is to allow the decision maker to feel completely comfortable with the system -- confident of his personal ability to communicate with the system in a straightforward manner, and to restructure the model so as to test a wide variety of policy alternatives in an intuitive fashion.

Other European Usage

One must not discount the possibility, however, that the success of such a financial planning system at UCL was an anomaly made possible by this university's status as a private institution; most European universities, of course, are much more tightly controlled by the state. Experience in the United States indicates that there is indeed a difference in system usage between private and public universities, but that this difference is one of area of application rather than of intrinsic usefulness of such a managerial tool. Whereas private institutions use such a system predominantly to analyze the financial implications of alternative operational policies and budgetary strategies, public institutions have found EFPM helpful in modeling the interactions between state financing policies and institutional operating needs (so as to better argue the university's case before appropriate governmental

decision-making bodies) and in analyzing the operations of various service units of the institution so as to improve their effectiveness within available resources.

There is reason to believe that such an analytical tool would also be found useful by the state educational ministries themselves. Certainly the context-free nature of a modeling system such as EFPM would permit construction of a financial (or enrollment, or personnel) model of an entire system of universities as easily as that of an individual institution. Moreover, even though it is occasionally argued that decisions at the ministerial level are made on a predominantly political -- as opposed to analytical -- basis, there still remains the necessity to assess the financial implications for the government of the alternatives under consideration, whether or not they be politically motivated.

Distribution System

Having demonstrated the effective international usage of a generalized modeling system such as EFPM, the remaining technical question to be addressed is the distribution of, or access to, such a system. In the United States, access to EFPM is available over two commercial dial-in data networks, TYMNET and Telenet. At present, colleges and universities in 225 large and medium-sized U.S. cities can reach EFPM via a local phone call, and this availability of dial-in locations is rapidly expanding. Such a network usage is coordinated through the auspices of EDUNET, a non-profit organization created to facilitate account initiation, billing, and remote user services for network access to university computers. Complementing their system of domestic dial-in centers, TYMNET and Telenet have also established communications ports in 57 Canadian cities, and in the capitals or principal cities of 26 other countries

in Europe, the Middle East, the Far East, and Oceania.

Several possible strategies for international distribution of EFPM are now being explored. The use of TYMNET or Telenet on an international basis is technically feasible, as has been demonstrated by a recent test of EFPM from Australia. The cost, however, is significantly higher than for network access from within the United States, averaging $20 to $50 per connect hour (depending on the country) compared to $4 per hour in the U.S. -- note that these communication costs are in addition to the charges for running EFPM on the computer at Cornell University, which averages $5 to $10 per connect hour. Alternatively, the programs could be housed at a set of host computers in Europe or other locations, allowing widespread system usage to the extent that telecommunications facilities are available and adequate. As a final alternative, EFPM could be developed as software to be distributed to individual users, with accompanying technical problems of installation as the major drawback to be anticipated.

One benefit of the existing single host computer arrangement, accessed remotely by all users, should not be minimized. The inter-university communications made possible by such a network system have resulted in an unprecedented level of sharing between participating institutions: voluntary sharing of implementation experiences, of common managerial concerns, of specialized model applications, and even of actual data files. The possibility of encouraging such widespread communication between institutions on an international basis is truly an exciting goal that merits continued development and dissemination efforts.

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